SCIENCE.

FRIDAY, FEBRUARY 6, 1885.

COMMENT AND CRITICISM.

That a wide-spread dissatisfaction with the past management of the U. S. department of agriculture exists, is obvious; but, beyond the somewhat puerile scheme for improving the department by a change of name and an access of official dignity to its chief, public discussion has been mainly confined to a consideration of the merits of various candidates for the position. A noteworthy exception to this rule is to be found in an article in the *Pacific rural press* of Jan. 3, by Prof. E. W. Hilgard of the University of California. This article is an abstract of a longer article by the same author in the *Atlantic monthly* for May, 1882, and is especially timely at the present moment. The gist of Professor Hilgard's proposition is to make the office of commissioner of agriculture less, and not more, of a 'political' office, than at present, or rather to remove it from politics altogether. Instead of a cabinet officer, changing with each administration, if not oftener, he would have him "a technical expert, not only responsible to the government, but amenable to that rigorous and incorruptible tribunal constituted of his scientific and technical compeers, and under the standing menace of a loss of his professional reputation, which no whitewashing committees, in or out of congress, could in any manner condone or undo."

We pass over Professor Hilgard's many other excellent suggestions regarding the management of the department, because this one appears to us to be the one fundamental reform which is needed, and which, if once secured, would be followed by the others as naturally as daylight follows the dawn. The coast and geodetic survey, and the geological surveys, have shown what government organizations can accomplish when divorced from politics, and directed by competent professional men holding office during 'good behavior.' The interests of agriculture are second to none in our country in magnitude, or in the novelty and difficulty of the problems presented. In no direction could a thorough knowledge of the art and science of agriculture find a wider or more attractive field for its exercise. In the interest alike of agricultural science and of practical agriculture, we hope that Professor Hilgard's suggestions may be speedily realized, and that the office may be rendered attractive to the class of experts from among whom it ought to be filled, but who, under the present condition of affairs, are neither thought of for the position, nor could afford to accept it if asked.

We have a prize offered by an American, one who would be known as a Good Samaritan, no doubt; and this prize, offered as it is for the discovery of a new comet or asteroid, has two singular conditions attached. First, the discoverer may not be of the continent of Europe. This condition is singular. Does not the European buy the wares of the Good Samaritan, or is it that the most successful seeker for little planets is a resident of the European mainland? It would seem that in the community of scientific men it would be as well that a Frenchman or an Austrian should have the honor, and should be encouraged as much in the discovery of a little ball of wandering rock, or of a comet, as that an Englishman, or an American, or a South-Sea Islander should have his ambition for scientific glory stimulated by the hope of a prize. Still there can be no serious objection to the giver limiting the competitors for a prize as he may see fit.

A second condition carries with it some dangers. The discoverer must, without notice to others, send word to the director of the ob-

servatory which our Good Samaritan has seen fit to establish; and only then shall the discoverer make his observation generally known, when he shall have received acknowledgment from the director mentioned. Now, it is important for the proper observation of any new wanderer that the news of it should be sent about the world without delay. The earliest observations of a comet are of especial value in fixing its orbit, and may, with bad weather or other mishap, be the only ones. A well-organized system for the collecting and transmitting of such information exists, and it is surely to be regretted that any condition should be attached to a reward which shall interfere with the benefits to be derived from the success of the worthy investigator. Such a condition is that which requires the competitor for a Warner prize to send word to Rochester before he can give the information to the International association of observatories.

Every worker in a special field of scientific or technical study must from time to time feel depressed under the difficulty, indeed too often the impossibility, of keeping himself well informed on what the world is accomplishing even in his own narrow department; so rapid is the succession, and so wide the separation, of papers and books treating of his subject. At such times he can appreciate the value of well-prepared current bibliographic records. The geographer turns to the monthly lists in *Petermann's mittheilungen*, or to the annual one published by the Berlin geographical society; the geologist has the *Neues jahrbuch*, and would gladly refer to the *Geological record* if it would only continue to appear in as good form as it began a few years ago; the zoölogist has his *Anzeiger*, *Record*, and *Jahresbericht;* and the chemist and the physicist are equally well cared for. But these extended lists are matters of provocation to many persons who cannot reach the books they name: for them a record is better suited that limits its selections by place instead of by subject, and gives a list of all kinds of publications on a certain geographic field. Two of these are mentioned in our notes, and both suggest the value of a similar work for our own country. The scope of such a volume would be sufficient for the purposes of many of our readers, if it included a record of the title, and a brief mention of the contents, of every thing written concerning our physical and natural history year by year. If undertaken by a number of specialists, the work would not be too laborious, and it would surely find publisher and purchasers. Why should not the Smithsonian institution undertake it?

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Anthropos and anthropopithecus.

I am glad that Professor Haynes, availing himself of my references, has refreshed his memory on de Mortillet. He will not again confound the age of St. Acheul with the axe of St. Acheul; and he and other readers of *Science* will now be aware that de Mortillet teaches that not man (the *anthropos*), but the man-ape (the *anthropopithecus*), was the representative of our species during most of the paleolithic period.

But why does the learned reviewer confine himself to the passages I pointed out to him? Why did he not turn to de Mortillet's work (p. 104), where he says, "L'homme quaternaire ancien n'était pas le même que l'homme actuel"? And where in the geologic horizon does de Mortillet place the arrival of *l'homme actuel?* Let any reader turn to the table of contents of the volume, and he will find that it is divided into three parts: 1. L'homme tertiaire; 2. L'homme quaternaire; 3. L'homme actuel. The last mentioned arrived, says the author, after a long and unexplained hiatus, *with the period of Robenhausen* (p. 485). Only in that period does de Mortillet concede to man his distinctive psychological traits of a language and a religion. Speaking of the very last of the Magdalenian period, he says, "L'homme quaternaire était complétement depourvu du sentiment de la réligiosité."

D. G. Brinton, M.D.

Dr. Brinton seems to be unfortunate in understanding de Mortillet's opinions, as well as in quoting his language correctly. Owing to the exigencies of space, 'the readers of *Science*' must be referred to the book itself, where they will find it stated that there is no conclusive proof that funeral practices prevailed in western Europe in quaternary times, and that such usages came into vogue there in the neolithic period. *Hinc illae lacrymae!* This is the sole foundation for Dr. Brinton's monstrous assertion "that de Mortillet teaches that not *man*, but the *man-ape*, was the representative of our species during most of the paleolithic period." De Mortillet's real views will be found summed up on the last page of his work, in twelve 'general conclusions,' so clearly and tersely 'that he who runs may read.'

Henry W. Haynes.

[A translation of this summary will appear in our next issue. — Ed.]

The Yellowstone Park as a bison preserve.

Permit me to thank you for your timely remarks in No. 103 upon the threatened extinction of the American bison. The question seems to be, as you state it, whether the bison (and with equal propriety, say I, a large number of other decadent types) can be successfully domiciled within the boundaries of the Yellowstone Park. Having given this subject careful attention, I am prepared to say that the practicability of the scheme admits of no reasonable doubt. The park itself is to-day one of the few regular retreats of the existing herds of buffaloes, and nothing but the protection intended by the laws is really needed for their preservation. Of late years much has been done by the superintendent and his efficient corps of aids, vigorously seconded by the territorial authorities of Wyoming. But the laws are not yet sufficiently punitory, and there is no provision for insuring the retention of the animals within the limits of the reservation. The superintendent, in a late report, refers to the presence of a few straggling bands at various points in the park, but apparently he considered them more as 'stragglers' than as legitimate denizens.

If the end in view, as suggested above, be the fostering of all animals which the national park may readily sustain, much more vigorous effort is demanded. The importation and semi-domestication of such exogenous forms as are in imminent danger of extinction should be encouraged; and why may we not look with great expectations upon such local scientific societies as are already organized in Denver and San Francisco? I have never seen a specimen of the Aplocerus montanus, nor have I met any one who has known it in its native haunts; but it is not wholly extinct. This species of antelope, incorrectly called the Rocky-mountain goat, should be preserved in the park, at all hazards. The big-horn (Ovis montana) is still living in Colorado and elsewhere; but it cannot long withstand the ravages of the hunter and the inroads of the mining industry. There is a very short lease of life for the grizzly bear under present conditions, and the beaver is rapidly disappearing.

Fortunately for our object, most of these animals have wandered into the park, and but little care will be required to retain them within its borders. Still there is needed some more capable and responsible supervision than has yet been secured by legislation; and experience has shown the influence which men of science have been able to exercise in similar cases. A committee of the American association for the advancement of science, appointed at the Nashville meeting, was able to obtain an appropriation from congress of ten thousand dollars, to be applied to the increase of accessibility to the geysers and thermal springs; and quite recently more has been done in that direction, and in the way of stopping lawlessness and depredations. Now is the time, and scientific men are the legitimate instruments, for completing the work by united action in support of this vast zoölogical garden, and of the collection of representatives of the many dying forms of our American fauna.

THEO. B. COMSTOCK.

Cleveland, O., Jan. 27.

The muskrat carnivorous.

Some twenty years ago, and from that time on for ten years, I was in the habit, with some friends of similar tastes, of closely searching the river-banks of this vicinity, and the waters, too, when practicable, for the aquatic mollusks which then abounded. The muskrats, now nearly extinct among us, were then numerous; and we soon learned that they were excellent collectors of shells, bringing out great numbers of the deep-water mussels of several species not usually very easily found by us, and leaving the shells in perfect condition.

In the rocky banks were many caves where shells were thus gathered; and one, especially on the south bank of Rock Island, a large space, well sheltered, and above high water, contained many bushels, — the accumulations, apparently, of a long period, but very fresh in appearance, and well preserved. Among the species most numerous were Unio cornutus, U. metaneorus, U. securis, and U. pustulosus. Many other species were found in less numbers, — U. rectus very rarely (though numerous in the river), and U. monodontus never. These heaps we examined with the utmost care, and obtained hundreds of fine specimens. During those years the muskrats still inhabited these places, and, except in winter, constantly brought out quantities of fresh shells, which we conscientiously appropriated. It was also very common to find heaps of fresh shells on or beside a stump, log, or rock, a few feet, or sometimes rods, from the water. We not infrequently found shells which had been gathered since the preceding day, as shown by shreds of the soft parts adhering to the shell being undried.

An open question with us, often asked but never answered, was, 'How do the rats open the mussels?' The first attempt at an explanation, which I remember to have seen, was in the remarks of Mr. W. S. Lee at a meeting of the Trenton natural-history society (*Science*, vol. iv. no. 94, p. v.).

Of course, we cannot gainsay what Mr. Lee has *seen*, that the animal 'apparently' held the mollusk's foot with his claws, preventing the closure of the shell. It would perhaps require a pretty strong grip to counteract the force of the powerful adductor muscles of the mollusk, with the pressure of the rat's paws at the same time tending to *press the shell together*. Again: one cannot help wondering how "the muskrat swam ashore, holding the mussel between the fore-paws," while the weight of the mussel would tend to pull the animal's head down, and, without the use of the fore-paws, how he could swim. We also wonder how, without relaxing his grip, he carried his burden, as was usually the case, to some distance from the water.

In *Science*, vol. v. p. 65, Mr. W. M. Beauchamp gives some curious explanations. He does not state where he saw "the statement that the carnivorous habits of the muskrat have but just been discovered by scientific men." Of course, everybody who knows the muskrat at all has always known that it is not worth while to bring proof of a fact so universally known.

"The four principal ways in which the muskrats get at the animal in the mussel-shell" may deserve a moment's attention. 1°. In our experience, the Anodons among the muskrat-heaps were very rare: they evidently preferred Unios; and in no instance were the Anodons in the shell-heaps found in a condition indicating that one valve had been torn off to open it. It was not uncommon to find, just along the water's edge, the tracks of the raccoon; and along these tracks were often to be found the Anodons, with one shell torn off or crushed. The coon seemed to prefer the Anodon, probably having no means of opening the Unio. 2°. The Unios were *never* observed with 'the thinner end of the shell,' or either end or edge, broken away. 3°. While he 'has heard' that the rats sometimes gnaw away the hinge-liga-

ment, it was a matter of common observation with us that such an instance *was absolutely never met with*. Among thousands, and hundreds of thousands, the ligament was always preserved intact. 4°. As to the astute creature 'allowing the animal to freeze and open,' we will not attempt to question that. It may occur to some readers that it would be rather monotonous for the hungry rat to wait during the hot summer nights (even at 'the west and *south*') for the stupid mussel to 'freeze and open.' That, however, is his business, not ours. W. H. Pratt.

Davenport, Io., Jan. 28.

THE GEORGIA WONDER-GIRL AND HER LESSONS.

The people of the interior states are now being amused by an exhibition the success of which offers a striking example of the unreliability of human testimony respecting the phenomena of force and motion. Some months since, the writer received a polite invitation to witness the wonderful performances of Miss Lulu Hurst, the Georgia 'magnetic girl,' in causing objects to move as if acted on by powerful forces, without any muscular action on her part. Another engagement prevented his acceptance; but, on the morning following, he received such a description of the phenomenon as to make him regret that he had not sacrificed every thing to the opportunity of seeing it. It was substantially this: —

A light rod was firmly held in the hands of the heaviest and most muscular of the select circle of spectators. Miss Lulu had only to touch the rod with her fingers, when it immediately began to go through the most extraordinary manoeuvres. It jerked the holder around the room with a power which he was unable to resist, and finally threw him down into one corner completely discomfited. Another spectator was then asked to take hold of the rod; and Miss Lulu, extending her arms, touched each end with the tip of a finger. Immediately the rod began to whirl around on its own central line as an axis, with such rapidity and force that the skin was nearly taken off the holder's hands in his efforts to stop it. A heavy man being seated in a chair, man and chair were both lifted up by the fair performer pressing the palms of her hands against the sides of the back. To substantiate the claim that she herself exerted no force, the chair and man were lifted without her touching the chair at all. The sitter was asked to put his hands under the chair: the performer then put her two hands around and upon his in such a way that it was impossible for her to exert any force on the chair except through his hands; yet the chair lifted him up without her exerting any pressure heavier than a mere touch upon his hands. Several men were then invited to hold the chair still. The performer began to deftly touch it here and there with her fingers, when the chair again began to jump about in the most extraordinary manner, in spite of all the efforts of three or four strong men to keep it still or to hold it down. A hat being inverted upon a table, she held her extended hands over it. It was lifted up by what seemed an attractive force similar to that of a magnet upon an armature, and was in danger of being torn to pieces in the effort to keep it down, though she could not possibly have had any hold upon the object.

This was the account of the performance given, not by a gaping crowd nor by uncritical spectators, but by a select circle of educated men. To the reminder that no force could be exerted upon a body except by a reaction in the opposite direction upon some other body, and to the question upon what other body the reaction was exerted, the narrators expressed themselves unable to return an answer. All they could do was to describe things as they had seen them. Of only one thing could they be confident: the reaction was not exerted through or against the body of the performer. Among the spectators were physicians and physiologists who grasped Miss Lulu's arms while the extraordinary motions went on without finding any symptoms of strong muscular action, and who, feeling her pulse after the most violent motions, found that it remained in its normal state. Apparently the objects which she touched were endowed with a power of exerting force which was wholly new to science. Altogether, the weight of evidence seemed as strong as in the best authenticated and most inexplicable cases of 'spirit' manifestation, while none of the obstacles to investigation connected with the latter were encountered.

Such was the case as it appeared on a first trial; but the spectators were not men to be satisfied without further investigation. Accordingly, they had made arrangements with the managers to have another private exhibition at the Volta laboratory two days later. They proposed also to have decisive tests to determine whether or not she exerted any force upon the objects which she moved.

The party duly appeared at the appointed time. At this point I think it only just to mention the perfect frankness with which the most thorough investigation of the case was permitted by those having the exhibition in

charge. There was no darkening of rooms, no concealing hands under tables, no fear that spirits would refuse to come at the bidding of a sceptic, no trickery of any sort. The opportunities for observation were entirely unrestricted.

Miss Lulu was a rosy country girl, somewhat above the average height, but did not give the impression of muscular training; still, when she was presented to those present, the first thing which struck the writer was the weight of her arm. Shaking hands with her felt like moving the arm of a giant, and led to the impression that she had a much better muscular development than would have been supposed.

Before proceeding to the tests which had been pre-arranged, it was thought best to try what she could do under ordinary circumstances. Among the first performances to be tried was that of the hat. A spectator held a light straw hat in his hands, the opening upwards. Miss Hurst extended her hands over it so that the balls of her thumbs just touched the inner face of the rim. At first there was no result, but after a few trials the hat was gently attracted upwards as if by electricity. Had those in charge been professionals, I cannot doubt that they would have stopped right there, and declined to repeat the performance. Not being such, they yielded to the invitation to go on, so that the holder could see how it was done. This was soon effected without difficulty. Whenever the apparent attraction was exerted, it was through the inner edge of the brim being caught in the fold of the ball of the extended hand. After a few moments the observer was enabled to say, "She cannot lift it now, because her hand is not rightly arranged," and he learned to adjust her hand so that the lifting could be executed. Of course, the force was not very strong. The idea that the hat would have been in any danger had a weight been in it was simply a mistake.

Next the jumping-staff was tried. The writer took the latter in his hands, and Miss Lulu placed the palm of her hand and her extended thumb against the staff near its two ends, while the holder firmly grasped it near the middle. He was then warned to resist with all his force, with the added assurance that the resistance would be vain. Sure enough, the staff began to be affected with a jerking motion, producing the disastrous effects which had been described upon the holder's equilibrium. An unwise repetition of the performance, however, did away with all its mystery; for, although the performer began with a delicate touch of the staff, the holder soon perceived that she changed the position of her hands every moment, sometimes seizing the staff with a firm grip, and that it never moved in any direction unless her hands were in such a position that she could move it in that direction by ordinary pressure. An estimate of the force which she exerted on the staff could be roughly made. It might have been as high as forty pounds. A very little calculation will show that this would be sufficient to upset the equilibrium of a very heavy man. It is impossible for the latter so to place his feet that he will be supported on a rectangle of more than one foot in breadth. He may indeed change at pleasure the direction of the longer side of this rectangle by extending his feet in different directions; but, arrange them as he will, his base will under any circumstances be a rectangle whose length is equal to the distance between his feet, and whose breadth is at the very maximum equal to the length of his feet. A pressure of one-fifth his weight would, under the most favorable circumstances, throw him off his balance, and make a new adjustment necessary. The motion given by the performer to the rod was not a regular one, which could be anticipated and guarded against, but a series of jerks, first in one direction, and then in another; so that it was impossible for the holder to brace himself against them: consequently, by a force which might not have exceeded forty pounds, he was put through a series of most undignified contortions, and finally compelled to retire in total defeat.

The holder of the rod then asked that it might be made to whirl in his hands in the manner which had been described to him. No attempt was made to do it, and no satisfaction on the subject could be obtained. It was evidently a simple mistake in memory or narration, for not even Miss Lulu seemed to have any idea of producing such an effect. The lifting of the chair with the sitter's own hands under it, and Miss Lulu's hands under his, was then tried. The simplicity of the blunder was most striking. It was quite true that the fingers of the performer were under those of the sitter. But the chair refused to budge until the ball of her hand came firmly in contact with it; and then it proceeded, not indeed to lift the sitter, but to incline itself in such a way that he felt compelled to get out of it. The chair was made to repeat its performance a great number of times. The writer watched most carefully, and, in every instance in which he was able to see the performer's hands at the time of the motion, the ball was pressed firmly against the

chair, and the direction of motion was that of the pressure.

Three men, or indeed as many as could get hold of the chair, were then invited to hold it still if they could. This was the most amusing and exciting part of the spectacle. The men tried in vain to hold the chair still, while Miss Lulu simply moved around in the quietest imaginable way, touching it with her finger first here and then there, until finally the force became so great that the chair began to crack, and seemingly almost pull itself to pieces. The explanation was, however, perfectly obvious. There was no concert of action among the four muscular holders, more than that each one tried to keep the chair still by resisting any force which he felt it to exert. A few jerks in various directions by the performer led them to begin resisting her motion by pulling the chair first this way and then that. It was of course impossible for any one holder to tell whether the motion came from the performer or from his companions. The result was, that they all began to wrench desperately against each other until the chair came to pieces.

The scientific tests were productive of the usual result, — that ghosts, spirits, and occult forces absolutely refuse to perform their functions in the presence of scientific paraphernalia. A platform had been placed on rollers in the middle of the room, and Miss Hurst was invited to set the rod in motion while she stood on that platform. Her parents were perfectly confident that she could do it, and she did go so far as to commence one feeble attempt; but the forces refused to operate, or rather the platform persisted in rolling about, and the attempt had to be given up. She then stood upon the platform of a pair of scales, the counterpoise of which was so adjusted, that, when she exerted a lifting-force exceeding forty pounds, the arm would be raised. A spectator sat in the chair in front of the scales. It was soon found, that, owing to the platform being some six inches above the floor, the chair was lower than she had been accustomed to have it: it was therefore set upon a little platform of the same height as that of the scales, so that the position was the same as if both stood on the floor. The performer pressed her hands against the sides of the back of the chair, according to custom. The motion was long in commencing, and, when it began to appear, click! went the lever of the scales, showing that a force of more than forty pounds was exerted. This seemed to demoralize the performer, and, notwithstanding a great deal of chiding from her parents, nothing more could be done while she stood in this position.

From various allusions in the public press, it would seem that the wonderful 'magnetic girl' has not yet ceased to draw full houses. The editor of the Chicago *Inter-ocean* made a careful investigation of the case, and showed that it could not possibly be electricity which caused the motion; but he does not essay an explanation of what the force was.

Although it would be unjust and pretentious to say that no one sees the absurdly simple character of the performance, it would appear that there are many who are mystified by it, and that, should we accept the existing testimony on the subject as complete, we should be compelled to admit that some new form of force had been discovered. It is indeed possible that the absurd simplicity of the affair may help to give it vitality; for, as already indicated, not only is there no mystery or concealment, but there is not even a resort to the tricks of legerdemain, which consist very largely in distracting the observers' attention at the critical moment. The assumption, that, because Miss Lulu begins by touching the articles deftly with her fingers, she never takes them with a firm grip, is one which the spectator takes upon himself without any effort on the performer's part to cause that illusion.

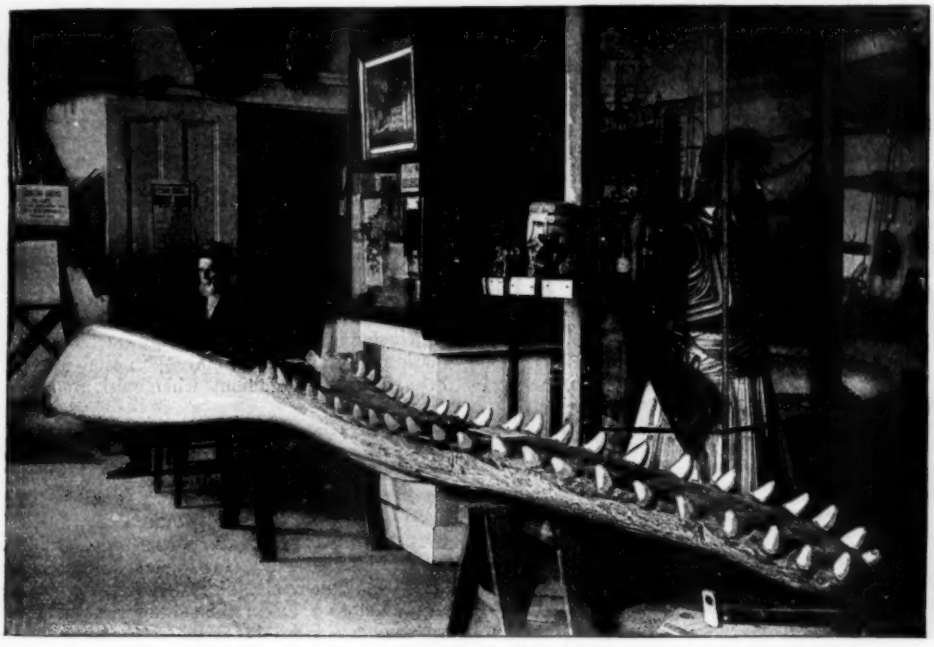
This account is presented to the readers of *Science*, because, taken in connection with descriptions of the performance given by thousands of spectators, many of them critical observers, it affords the basis of a reply to those who have seen chairs, tables, and pianos dance without human agency.

S. Newcomb.

THE NANTUCKET MUSEUM.

The little town of Nantucket, on the island of that name off the southern coast of Massachusetts, boasts a little museum *sui generis*. The first thing which strikes a visitor is the extremely heterogeneous character of its collections. It is certainly amusing to see, side by side with specimens of rare interest and scientific value, such entirely valueless things as pieces of melted glass from the Chicago fire, and bits of wood from the frigate Constitution; but most of the 'curiosities' have some local value, being connected with the past whale-fishery, and were collected by the whalemen of the town in their wide wanderings. Hanging on the walls, lying on the tables and even on the

floor, are savage implements and curiosities, which cannot fail to interest the visitor, especially as they are all explained by the curator, Mr. Murphy, who has thrilling tales to tell of each separate piece; nor is the curiosity-hunter the only person who is likely to be interested in this museum. In its collection of tropical shells, there are many which cannot be numbered among the commonest; but, for the naturalist, the one thing which possesses an all-absorbing interest is the sperm-whale's jaw, which extends nearly across the exhibition-room. The curator, who considers this his special pet, is full of enthusiasm for it, and claims that it is the only full-grown jaw of a sperm-whale in America. It was taken in 1865 by a Nantucket whaler in the Pacific Ocean, from a sperm-whale which measured eighty-seven feet in length and thirty-six feet in circumference, and had the enormous weight of two hundred tons. The whale gave forty-five hundred gallons of oil. The jaw itself weighs eight hundred pounds, measures seventeen feet in length, and has forty-six huge teeth. These are badly worn, and prove that the animal must have been very old. In connection with the jaw, Mr. Murphy describes the animal, tells about its enemy the whale-killer, its parasites and other pests, explains the process of killing the whale and cutting up and trying out the blubber, illustrating his talk either with the apparatus itself or with ingeniously made models. On the other side of the room is a small jaw twisted in a spiral direction, and bearing plain evidences of having been injured at an earlier stage. The teeth are long and somewhat slender, partly from the youth of the animal, partly from disuse. When taken, the whale was alive; but the lower jaw was badly aborted, and the animal was in a poor state. It must have been in this condition for years, and have lived upon what chanced to come in its way. It is to be hoped that the collection may always be well cared for, and may become more than now the nucleus of a good collection of the natural objects of Nantucket itself.



THE 'COMMA BACILLUS' OF KOCH.

DR. KOCH has himself stated in precise terms the nature of the proof required in order to es-

tablish in a definite manner the specific pathogenic power of a micro-organism, which, by its presence in the blood, tissues, or alimentary canal, may be supposed, *a priori*, to bear a causal relation to the disease with which it is associated.

This proof depends upon the production of characteristic morbid phenomena by inoculating susceptible animals with 'pure cultures' of the parasitic micro-organism previously found under circumstances to justify the supposition that it bears an etiological relation to the disease under investigation. This final proof Koch has attempted to obtain with reference to the so-called 'comma bacillus,' which, according to his observations, is constantly associated with epidemic cholera, and, after numerous failures, claims finally to have succeeded. In a late number of the *Deutsche medicinische wochenschrift*, he says, —

"The experiments of Rietsch and Nicati have been lately repeated at the Imperial board of health; a pure cultivation being so far diluted, that the amount injected contained scarcely a hundredth part of a drop of the cultivation liquid. The liquid was injected into the duodenum without previously binding the ductus choledochus. With few exceptions, the animals so treated died within a space of time extending from a day and a half to three days. The mucous membrane of the small intestine was reddened: its contents were watery, colorless, or slightly reddish tinged, and at the same time flaky. Comma bacilli were found in the contents of the intestine in a pure cultivation and in extraordinary numbers, so that the same phenomena were visible here as are seen in the cholera intestine in its fresh state. Owing to the small quantity of infectious matter used for injection, the idea of a simultaneous intoxication from poisonous matters contained in the cultivation liquid used for injection is excluded."[1]

In face of the previously reported failures to produce cholera in the lower animals, we are disposed to receive the proof now offered with some reserve, inasmuch as the injections seem to have been made through the walls of the abdomen directly into the intestine. This method has, no doubt, been adopted upon the supposition that previous failures were due to destruction of the bacilli by the acid juices of the stomach when they have been introduced by the mouth. There is nothing improbable in this supposition; but, on the other hand, the possibility that when the material is injected directly into the intestine the puncture made may have been a serious complication and source of error, at once suggests itself.

That micro-organisms closely resembling the 'comma bacillus' are to be found in the healthy human mouth, and in the discharges of patients with other forms of intestinal flux, cannot be doubted; but that these are identical with the 'comma bacillus' cannot be established upon morphological grounds alone. If one 'comma bacillus' in pure cultures produces cholera, and another having identical morphological characters does not, we must admit an essential difference — physiological — which, if constant, must be considered a specific character, equal in value to a constant difference in form or in color. If such difference is not constant, it will at least establish a pathogenic variety of the ordinarily harmless organism. But this is not the state of the question as regards Koch's 'comma bacillus:' for in his answer to Prof. T. R. Lewis of the English army medical school, who asserts that a curved bacillus, identical with the 'comma bacillus,' is found in normal human saliva; and to Professors Finkler and Prior, who claim to find similar organisms in the discharges of patients with cholera nostras (sporadic cholera), — Dr. Koch shows very conclusively that the organisms referred to are not identical with the 'comma bacillus,' although bearing some resemblance to it. This conclusion is based both upon appreciable morphological differences, and upon the different behavior of the organisms when cultivated upon gelatine.

Through the courtesy of Dr. Billings of the army, I have recently had an opportunity to study the morphology of the 'comma bacillus,' having had in my possession for several days a slide sent by Koch himself to the Army medical museum. My laboratory assistant, Dr. A. C. Abbott, has made for me a camera lucida drawing, which, I think, fairly represents the organism as seen in this slide, and which is reproduced in fig. 1. Each separate cell was drawn under the camera lucida; but the field as a whole is an ideal one, as I desired to show in a single figure all of the forms found in the slide. As a matter of fact, the 'commas' as seen at *a* are by far the most numerous, and are found clustered in groups and masses; while the characteristic spirilla, such as may be seen at the centre of the field at *i*, are comparatively scarce. Still, in view of the intermediate forms, as seen at *c*, I cannot doubt that we have here a pure culture of a single organism, and that this organism is in truth a spirillum, and not a bacillus. If one saw only such forms as we have delineated at *e*, there would be no hesitation in pronouncing them bacilli; and the name 'comma bacillus,' from a morphological stand-point, applies very well to the prevailing form, as seen at *a*. It is not sur-

[1] Quoted from the *British medical journal* of Nov. 22, 1884, p. 1036.

prising that at the outset Koch spoke of the swarms of rods, straight or slightly curved, which he found in the intestines of cholera patients as bacilli; and, indeed, the fact that these rods were capable of developing into spiral filaments could only be determined by protracted observations and by making pure cultures. It seems to me that some of Koch's critics, and especially Ray Lankester (see his paper in *Nature*, Dec. 25, 1884), are making altogether too much of this very pardonable mistake, which has no special bearing upon the real question at issue, and cannot weaken our confidence in the candor and scientific accuracy of a man to whom we are so deeply indebted, and whose scientific reputation is established upon a firm foundation.

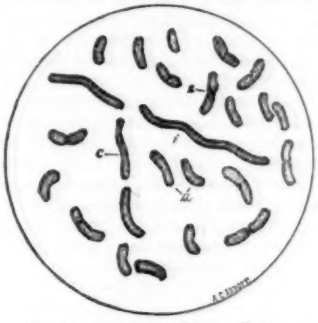


FIG. 1.—COMMA BACILLUS (Koch) × 2,500 diameters.

Ray Lankester is unquestionably right when he says that our knowledge of the bacteria is still in its infancy; but, so far as this knowledge goes, it is doubtful whether any man living can speak with more authority than can the discoverer of the tubercle bacillus.

The amplification in the figures illustrating this paper is exactly twenty-five hundred diameters, and was obtained with admirable definition by the use of Zeiss's one-eighteenth inch homogeneous immersion objective upon a Powell and Lealand's large stand, with a high eye-piece, and the draw-tube extended one inch. The measurement was made by projecting the lines from a standard stage-micrometer, ruled by Professor Rogers of Cambridge, Mass., upon a sheet of paper in the exact position in which the drawing was made, by means of the same objective, eye-piece, and camera lucida. Fig. 2 was made in the same way, and represents curved bacilli, which resemble the 'comma bacillus,' and which are, perhaps, identical with those described by Prof. T. R. Lewis as found in the healthy human mouth. The specimen from which the drawing was made was one of sputum from a patient with pneumonia. I think it hardly necessary to insist that the bacilli in fig. 2 are not morphologically identical with the 'comma bacillus' of Koch as shown in fig. 1; and I may say here, that, during my somewhat extended bacteriological studies, I have never encountered an organism which seems to me to be identical with that seen in the slide above referred to. Should such an organism be found, it would not in the least weaken the experimental evidence relating to the specific pathogenic power claimed for this spirillum. But we must insist, in any case, that this experimental evidence shall meet the most rigid exactions of science. Certainly, Koch fully appreciates this, and is doing his utmost to comply with the conditions which he has imposed upon himself. We are therefore not able to sympathize with the captious spirit of some of his critics. Nor, in the absence of a detailed report, are we prepared to admit that the English cholera commission has definitely settled the question as to the etiological *rôle* of the 'comma bacillus' during the comparatively brief time which has been devoted to the investigation; and, in view of the contradictory testimony now before us, we cannot do otherwise than consider the question still *sub judice*, and wait patiently for detailed reports and additional experimental evidence.

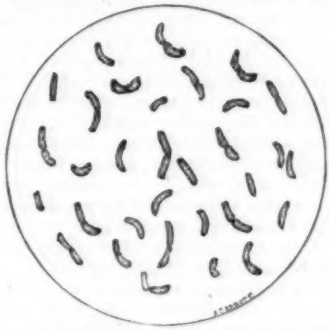


FIG. 2.—BACILLI FOUND IN PNEUMONIC SPUTUM × 2,500 diameters.

GEORGE M. STERNBERG,
Surgeon U. S. army.

LIGHTHOUSE ILLUMINANTS.

A PARLIAMENTARY document is not the place where one would naturally look for facts of scientific value: but, in a return published by the English house of commons on the 11th of December last, there is

much interesting information on the subject of light-house illuminants in the form of correspondence between the Board of trade, which has general supervision of the lights of Great Britain; the Trinity house, which manages the English lights; and the Commissioners of northern lights, who have control over those of Scotland.

It may be remembered that in 1883 it was proposed to make exhaustive tests of the relative value of petroleum, gas, and electricity, as illuminants for lighthouses, by comparing the several lights in actual operation together at the South Foreland station; and the lighthouse authorities of all three kingdoms had arranged to act conjointly in prosecuting the experiments. When, however, the conditions under which the trials were to take place were formulated, the representatives from Ireland considered that these would place the system favored by the Irish authorities — the Wigham gas system — at a disadvantage, and refused to take further part in the proceedings.

Dr. Tyndall, who had for years acted as scientific adviser to the Trinity house, but had prior to this resigned, then wrote certain letters to the newspapers on the subject. These letters appear, says the Board of trade, to assert the superiority of gas, as used in Mr. Wigham's burners, as a lighthouse illuminant; and, further, to imply that the engineer of the board, Mr. (now Sir James) Douglass, has not been entirely disinterested. The Board of trade therefore asked for a full report of the views of the English and Scotch lighthouse boards on the whole question; and their replies, which give a fair idea of the present state of development of illuminants adapted to this special purpose, may be taken to be the defence of the board against Dr. Tyndall's strictures.

From the learned professor's statement, it appears that in 1869, when he was sent to Ireland to make himself acquainted with the gas system of lighthouse illumination, colza-oil was used in the Trinity-house lamps; and this was superseded, at a vast saving to the country, by mineral oil. Mr. Wigham had succeeded in producing a gas-lamp superior in power to the best oil-lamp then extant. The gas-flame showed a promptitude of action and a pliancy of adaptation unattainable with oil. By a simple automatic apparatus, the gas-flame could be made to send forth flashes in any desired succession, and of any required duration. Long and short flashes could be combined so as to render the identity of a lighthouse unmistakable, or enable it to spell its own name by the Morse alphabet. Further, Mr. Wigham had surrounded his central 'bunch' with rings of burners, to increase the light in thick weather. In a few seconds a light-keeper could pass from 28 jets to 48, and thence with equal rapidity to 68, 88, and finally to 108 jets, all these flames being under the most perfect control. The best oil-flames then known were feeble scintillations, compared with the flame of the 108-jet burner. Dr. Tyndall adds to his own the testimony of many others as to the value of the Wigham system as then examined, and proceeds to describe a later visit to the lighthouse at Galley Head, which is now, he says, without a rival in the world. In this light the refracting-lenses of four first-order apparatus are fitted one above another in the same lantern, with a 108-jet burner in the focus of each apparatus. It had already been visited by the Elder brethren of the Trinity house; and their engineer's report, he claims, was the only one unfriendly to the light. In spite of the almost unanimous opinion in its favor, the Trinity house decided in favor of a six-wick burner consuming mineral oil (Sir James Douglass's patent). Finally, Sir James, says the doctor, recognized the merits of the gas system, and decided to adopt it, but for the extinction rather than with the co-operation of Mr. Wigham.

The Trinity house replies at considerable length, giving in full the result of its investigations into the worth of the Wigham light. From these observations, the Elder brethren derived an opinion that one prominent objection to it is, that the higher powers of the single burner are obtained by increasing its size. The diameter of the 28-jet flame is four inches and a quarter; that of the 48 is five inches and seven-eighths; and so on, until a diameter of eleven inches and an eighth is reached with the 108-jet burner. Then, as the prisms of the optical apparatus are adjusted to a focus within the confines of the small flame, it follows that a great portion of the enlarged flame is extra-focal, and distributed in directions not intended by the designer of the apparatus. This effect is not particularly important in a fixed light showing all around the horizon. By far the greater number of fixed lights, however, require to be either strictly confined in angular width, or marked with color within particular bearings, which is accomplished by interposing fixed vertical screens, opaque or of colored glass, close to the glazing of the lantern. Directly the diameter of the flame is enlarged, the screen will no longer cut off the light with precision on its appointed bearings: the ex-focal rays of white light will stray into the sector which should be dark or colored, and destroy the means of guidance for which the light is intended.

The diameter of the oil-burner being constant, and its flame more compact than the Wigham burner, — for instance, the six-wick oil-burner, four inches and three-eighths wide, being equal in power to the 48-jet gas, five inches and seven-eighths wide, — it follows that oil is, according to the facts before us, more suitable for important niceties of direction. Occultation — that is, the sudden and short eclipse, at regular intervals, of an otherwise continuous light — is effectively applied with either source of illumination, but in the Wigham system is applied to flashing lights in a novel manner, as an additional means of identification. A light showing one long flash every minute, is, by occultation at short intervals, made to show a number of short flashes instead of the long one. With a widening burner, the luminous beam becomes broader, and the number of flashes seen in each series becomes greater; so that the expansion of a burner involves a change in that distinctive character upon which the observer most relies. At Galley Head this uncertainty as to the number of flashes had been observed.

These considerations led the Trinity house to the opinion that the Wigham gas system in single form could in a very few cases be employed at its higher powers without risk of perplexing the mariner; that the highest power at which its single burner could be used under every required condition was also obtainable by oil; that its special novelties in distinctiveness, as introduced at Galley Head, would only be available at widely separated stations; and that where space and considerations of expense permitted the use of gas in triform or quadriform, electricity would also be admissible, and, by its suitability for optical treatment, would be better adapted for producing the effects required in coast illumination; and, finally, its own experience with the two gas-lighted towers at Hasborough was not such as to encourage a more extended application.

The Commissioners of northern lighthouses, in answer to the letter of the Board of trade, send a report from Messrs. Thomas Stevenson and J. A. Crichton, which, in the main, agrees with that of the Trinity house.

From the paper read by Sir James Douglass before the British association in Montreal may be gleaned a few facts as to the relative powers of the best lights now in use, which are not mentioned in the correspondence just described. He states that the first electric light used in an English lighthouse in 1858 was of 700-candle power, whereas an intensity of 50,000-candle units is now found to be practically and reliably available for the focus of an optical apparatus; so that, with regard to intensity, this luminary outstrips all competitors. Compact flames are now being produced from oils and coal-gas, having an intensity of 1,500 to 2,000 candles; while, with the 108-jet Wigham burner, an intensity of nearly 3,000 candles has been reached. With regard to economy, mineral oil has the advantage of all its rivals up to the maximum intensity at which an oil light is practicable, and has the further advantage over electricity or gas in its ready application at any station, however isolated, and in many cases where the use of the other illuminants would be impracticable. He proceeds to show that fixed lights are no longer to be considered trustworthy coast-signals, owing to their liability to confusion with other lights, and that the period of a light should not exceed half a minute; further, that time should not form an element in the determination of the distinctive character of a light. On the coast of England the Trinity house is converting all fixed lights to occulting, where local dangers are required to be covered with red sectors, or sectors of danger-light. For this the electric light is eminently adapted. In cases where this local mapping-out of dangers is not required, flashing lights, in consequence of their higher intensity, are being adopted.

Referring to the optical apparatus of the new Eddystone lighthouse, he describes it as consisting of two superposed tiers of lenses with a six-wick Douglass oil-burner in the focus of each. In this respect a part of Mr. Wigham's system has assuredly been copied. With a clear atmosphere, the lower burner only is worked at its minimum intensity of about 400-candle units, giving an intensity of the flashes of the optical apparatus of about 37,000 candles; but in thick weather the full power of the two burners is put in action, with an aggregate intensity in the flashes of the optical apparatus of about 159,000-candle units. This intensity is about 23 times greater than that of the fixed light latterly exhibited from the old tower, and about 2,380 times the intensity of the light originally exhibited in the same tower, at about the same cost, from tallow candles.

THE ESSEX DENEHOLES.

THE word 'denehole' means '*den*hole,' and is pronounced '*dane*hole.' Those of Kent and South Essex may be described as consisting of narrow vertical shafts leading to artificial chambers excavated in the chalk, their depth varying with the distance of the chalk beneath the surface. They are found singly, in groups of twos and threes, or in larger collections of perhaps fifty or sixty pits.

Our illustrations show two types of the varieties of form exhibited by deneholes. The beehive shape is especially common in the shallower pits, which are wholly, or almost wholly, in chalk. A drawing of a pair of such pits discovered in a chalk cliff at Crayford brickfields is given (fig. 1). Their depth was

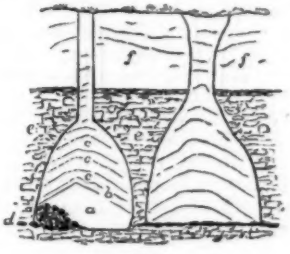


FIG. 1.

thirty-seven feet, and the greatest width eighteen feet. The walls showed no signs of metal picks, and the chalk blocks must have been prized out, but they were well and symmetrically worked. In one was a layer of very hard clay, washed into a cone at the bottom, and containing flint flakes, scrapers, and a 'core:' above that a layer of Roman pots and pans (a Samian dish, etc.) rested, followed by some very fragmentary and coarse potsherds and confused rubbish, apparently intended to fill the hole up to the surface of the ground. The sister-cave did not show an equal stratification of *débris*, and appeared to have fallen in at an early period.

Of the deeper deneholes existing in Hangman's Wood, one (fig. 2) is eighty feet deep. In three examples at Hangman's Wood (not figured) there were six chambers, while in two at Bexley only three chambers radiated from the shaft. A final stage in denehole evolution seems to have been the removal

of the greater portion of the partitions separating the chambers, pillars of chalk only being left to support the roof. The usual height of denehole chambers may be said to be from ten to twenty feet. A leading characteristic of deneholes is the separation of each pit from its neighbor, though they are often so close together that much care must have been exercised to prevent intercommunication. Another is the fact, that, while they are here and there abundant in bare chalk, they are often especially numer-

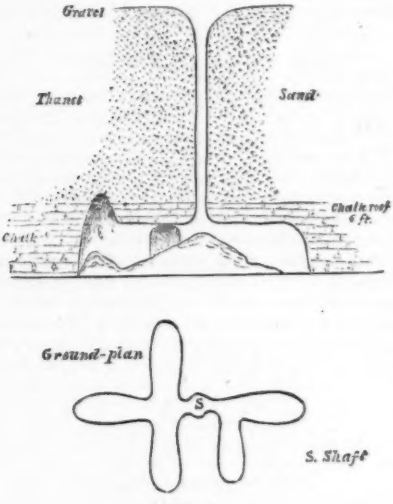


Fig. 2.

ous where the top of the chalk is fifty to sixty feet below. Thus at Hangman's Wood, for example, the top of the chalk is fifty-six or fifty-seven feet below the surface, while there is plenty of bare chalk within a mile.

Though there are more than fifty separate deneholes in Hangman's Wood, each shaft being at an average distance of about twenty-five yards from its nearest neighbor, only five shafts are now open, the rest having fallen in at various times. In most instances, however, there is nothing to suggest that the chambers below have been materially, if at all, injured, the funnel-shaped hollow at the surface being but little greater than those around the mouths of shafts still open. This closing of the great majority of the shafts is not by any means simply disadvantageous to denehole explorers, though it certainly increases the cost of exploration; for it is obvious that closed pits necessarily afford more satisfactory evidence than such as have been visited from time to time, either from curiosity or to recover a lost sheep or hound.

Preliminary examinations of six of the deneholes in Hangman's Wood were made during the summers of 1882 and 1883. A more thorough investigation is now in progress.

RECENT AFRICAN EXPLORATION.

No news has been received at Zanzibar from Giraud since he was deserted by his caravan. A number of the deserters have been arrested and imprisoned under grave charges, but their trial will be deferred until some definite information of the traveller's fate has been received. The French consul asserts, with reason, that an example must be made if it proves that Giraud has been betrayed: otherwise there can be no safety for future explorers.

The distressing news has been received of the total destruction by fire of the fine establishment of the missionaries du Saint-Esprit at Mrogoro. They were left without food or clothing, and the result of their severe labor for two years was destroyed at one blow. The fire would seem to have been accidental; since the natives about them are friendly, and have modified, at the suggestion of the missionaries, many of their savage customs, especially that of human sacrifices, which a year ago were common. Assistance has been sent to the sufferers.

From the Zambezi, news of the death of Commander Foot has been received. It occurred at Blantyre, where he had been appointed English consul. His wife and two children, unable during the prevalent disorders on the upper Zambezi to reach the coast, have taken refuge at the Protestant mission at the junction of the Ruo and Sheri rivers. The deceased was well known in connection with African exploration, and especially with routes of trade and travel in central Africa.

Mr. Hore of the English missionary society has recently started for Ujiji, with his family, a considerable caravan, and two young missionaries, who will assist him in his work.

Some time since, we referred to the operations of Paul Soleillet in the region of Shoa, and his success in establishing friendly relations with King Menelik. The traveller, who left France about three years ago, has now returned to civilization, and, at a recent séance of the Société de géographie, gave interesting details of his journey, and of the character of the region explored by him in the interests of French commerce. The port of Obok, opposite the English military station of Aden, has been occupied by France since 1856, but has only been raised to the rank of a naval coaling-station during the past year.

Behind Obok rises the irregular surface of the Ethiopian highlands, extending westward to the Nile, and southward to the little-known region which encloses the great lakes of equatorial Africa. At different altitudes on its ridges, which rise from five thousand to eleven thousand feet, one finds a succession of all the climates of the torrid and temperate zones. The olive, cypress, indigo, and coffee plants grow wild there; while cotton, sugar-cane, the vine, and cereals are successfully cultivated. In the same regions where the elephant, buffalo, and rhinoceros flourish in a state of nature, one finds innumerable herds of cattle, sheep, and horses. Soleillet succeeded in opening a caravan route to Kaffa by way of Shoa, which is subject to the usual objections of time and

expense, twenty or thirty days being required to reach the highlands from Obok. However, the only route previously available took forty or fifty days for the same transit. Transportation is very expensive, reaching four or five hundred dollars per ton; so that only the most valuable goods, such as arms and ammunition, can be profitably sent in, and gold, ivory, and musk brought out. However, Shoa has a population of three millions, intelligent and semi-civilized, whose manners and customs approach those of Europe, who are Christians, and are governed by a code of laws derived from the Institutes of Justinian. The construction of a railway of two or three hundred miles in length would open an immense market for the manufactured goods of Europe. Soleillet's labors have been rewarded by the cross of the legion of honor.

INGERSOLL'S COUNTRY COUSINS.

MR. INGERSOLL'S 'Short studies in natural history' is a revised reprint of a number of handsomely illustrated articles on a variety of subjects, which have recently appeared in various popular magazines. Of the twenty-one chapters, three are devoted to birds; one each to shrews and seals; three to oysters and their enemies; one each to rattlesnakes, squids and their allies, elk-antlers, the pompano shells, the caverns at Luray and at Pike's Peak, the abalone, shell-money of the American Indians, etc. On many of these subjects the author writes from personal observation; but much of the book, as might be expected, is compiled. In detailing his own observations, he seldom wanders from the mark; but, in treating subjects at second hand, he is occasionally betrayed into misstatements, either through inattention or by his authorities, whom he is not in position to properly weigh. We are surprised, for instance, that he should soberly repeat the assertion that mocking-birds are able to kill large snakes by beating them with their wings. He shows a not very clear conception of his subject, when, in speaking of the shrews, he states that the smallest American species belong to the genus Blarina; nor is this the only glaring inaccuracy in the chapter on these animals. A very excellent account of the large-billed water-thrush (Siurus motacilla) is marred at its close by the statement, 'This is a northern bird,' — the opposite of the truth, when contrasted, as here, with the small-billed species. Equally careless and inexcusable is the statement that martens, as well as weasels and ermines, turn white in winter. The interesting and very sensible article on 'Rattlesnakes in fact and fancy,' however, while not wholly free from errors, treats the subject of 'mimicry' in relation to the rattles with commendable judgment. In the account of star-fishes as enemies of the oyster, there are some overdrawn statements respecting the power of multiplication by division possessed by star-fishes. In the chapter on 'Periwinkles and other oyster-pests,' the large 'winkles,' or 'conchs,' of the genera Sycotypus and Fulgar, are erroneously stated to be unprovided with a lingual ribbon of teeth. The quahaug is said to be usually safe from the ravages of these species; but this is by no means the case, since at some localities we have found the quahaug to be their principal prey, even the largest specimens not escaping their rapacity. It is stated, on the authority of 'an intelligent man,' that Fulgar carica is able to draw even the razor-shell out of its burrow, and devour it; while the fact is that this is done by even very young examples. The chapter on 'Seals and seal-hunting in the North Atlantic' is far from accurate in many of its statements; but, strangest of all, under the page-heading 'A bit of comparative anatomy,' we are told that the tail of the whale, and of cetaceans in general, is not a 'tail' at all, but is structurally homologous — having the same component bones — with the hind-flippers of a seal and the hind-limbs of other mammals. Not to cite other frequent evidences of either carelessness or ignorance, the foregoing will show that a very readable, and in the main commendable, book may contain faults of a very serious character. The author tells us the book is written in the hope that it may "contain not only some entertainment, but also helpful suggestions for those who take delight in outdoor studies." It certainly does contain a very large amount of interesting information very entertainingly told, few writers of popular natural-history books having either the literary ability or the knowledge shown by Mr. Ingersoll in the present series of papers. It is the greater pity that here and there he should be found so grievously tripping.

The book is very carefully and attractively printed, and the illustrations are artistic and fitting; but even here the frontispiece is entitled 'Tree toads,' while only one of the two species figured is a tree-toad, though both are placed *on a tree;* the other being the wood-frog, and as such is correctly referred to in the text. In the explanation of the cut of a shrew's skull (p. 35), 'under side of skull' should be 'upper side of skull.'

Country cousins: short studies in the natural history of the United States. By ERNEST INGERSOLL. New York, *Harper & brothers*, 1884. 252 p., illustr. 8°.

THE FORESTS OF THE UNITED STATES.

Many essays and some books there are to tell us what should be done with our forests, or with their remains. This ninth volume of the reports of the census taken in 1880, now before us, tells us what these forests are. First and briefly as to their general distribution in accordance with the climate and configuration of the country. There is, in the most general terms, a forest of the Atlantic, and another of the Pacific region, widely separated through a long stretch of the continent, more approximate at their northern extremities, and essentially but loosely joined along the Mexican borders from Texas to southern California by a very peculiar arboreal vegetation. And even where the Atlantic and Pacific woods are most widely severed, as in about latitude 40°, the western own to a near relationship with the eastern along the line where the Rocky Mountains flank the plains. Together, the two compose one large whole, — a temperate North-American sylva, the harmony of which is not greatly disturbed by the intrusion of Mexican types into its southern borders. A more seriously discordant element, however insignificant geographically, but figuring rather prominently in the catalogue, comes as a consequence of the southward extension of the peninsula of Florida, upon which a good number of tropical West-Indian trees have effected a lodgment. Like other immigrants, these denizens must be received upon the same footing with those more truly to the manner born, although they sensibly impair the homogeneity of the United States sylva.

Next as to the genera and species of which our forests are composed, amounting, it appears, to a hundred and fifty-eight genera and four hundred and twelve species. A considerable number of these, however, are only arborescent at their best, never attaining the magnitude of timber-trees; and forty-eight of the genera, and nearly sixty species, occur only in semi-tropical Florida. The systematic account of the trees fills two hundred and twenty pages of the volume. It is wonderfully full, not to say exhaustive, in the bibliography and synonymy, is comprehensive as to geographical ranges, particular in its statement of the character of the wood (the specific gravity and the amount of ashes being specified under each species), and also its economical uses. But descriptive matters and all botanical details, beyond a mention of the height attained by the tree, are scrupulously omitted. Even the nature and appearance of the bark, characteristic as it generally is, and sometimes very important in its practical applications, is nowhere mentioned, except in a single line in a single case, that of the canoe birch. Even the difference between the cherry birch and the yellow birch, so striking in the bark and so slight in every other respect, is not alluded to. This is evidently done on principle. It was necessary to draw the line somewhere, and Professor Sargent has drawn it very taught. We should grieve inconsolably over the exclusion, except for our expectation that the author means to make amends in another work, in which the tree will stand for more than its timber. Let us note, in passing, that in any future publication 'Palmaceae' should give place to 'Palmae.' It was a good thought to supply a separate and full index to the 'Catalogue of forest-trees,' as this part of the volume is modestly entitled. The addition of as much descriptive botanical matter as there is of bibliography would have made of it a compendious treatise.

We will not complain that practical matters predominate in a census report. Part ii., 'The woods of the United States,' fills two hundred and forty pages, most of it tabular matter. 'Woods' are here used in the sense of timbers; and this portion of the volume records with much completeness the result of an exhaustive determination of the specific gravity, the amount of ash, the weight per cubic foot, the tensile strength, the behavior under compression, and the fuel value of the wood of all the species. This great piece of work was done by, or under the direction of, Mr. S. P. Sharples. The wood specimens are preserved in two full series, — one in the National museum at Washington, one in that of the arboretum of Harvard university; and the surplus material, worked into 12,961 museum specimens, has been made into sixty sets, and distributed to nearly as many educational institutions.

Any one wishing to know the relative specific gravity of the wood of our trees has only to consult the table beginning on p. 249. He will learn that all those which are heavier than water are of semi-tropical species, or of the arid south-western interior region; that the Floridian Condalia ferrea leads the list (specific gravity, 1.3020); that Cercocarpus ledifolius, the mountain mahogany of Utah, etc., comes up to 1.0731; that the lightest conifer-

Report on the forests of North America (exclusive of Mexico). By Charles S. Sargent, Arnold professor of arboriculture in Harvard college, special agent tenth census. Washington, *Government*, 1884. 612 p., 4°; 39 colored maps, 4° and f°; with portfolio of 16 maps, eleph. f°.

ous wood is of the big tree, Sequoia gigantea (0.2882); and that the lightest wood of all is of a fig in Florida, Ficus aurea (0.2616).

Upon part iii., 'The forests of the United States in their economic aspects,' which concludes the volume, and which the fine colored maps graphically illustrate, Professor Sargent has bestowed great pains, and to much purpose. The statistics of the lumber industry for the census year, the table of forest-fires during that year, the map showing the proportion of woodland within the settled area burned over in that year, and the map showing the character of the fuel used in different parts of the settled portion of the country, are most interesting and instructive. Not less so are the detailed and fully illustrated summaries of the present condition and character of the woodlands of every state and territory.

The principles of forest preservation, the needs of the country in this respect, and its importance in certain districts, also the special need, as well as great difficulty, of guarding against forest-fires, are touched upon as occasion serves. If the country suffers hereafter, it will not be from the lack of good advice. Possibly the forest report for the eleventh census may show that it has not all been wasted. If the forest agent for 1890 brings out a more valuable report than that of 1880, it will in a measure be due to the advantages furnished by the work of his predecessor.

SCHELLEN'S DYNAMO-ELECTRIC MACHINES.

THIS is a translation from the third German edition, with large additions and notes relating to American machines by Mr. Keith. In the first two editions of the original the work appeared in one volume; but in the third the author thought it desirable to divide it into two, and in this the translators have followed him. The first volume only is now published, and is principally devoted to methods and machines for producing electric currents.

It is not easy to keep pace with the production of dynamo-electric literature at present, and one cannot avoid the conclusion that much of it might be suppressed without really serious loss. Books on dynamo-electric machinery may be prepared for the general intelligent public, for the so-called 'practical' electrician, or for the student of electrical engineering. Dr. Schellen's book is not likely to satisfy the demands of either of these classes.

About a hundred pages bear the general title of 'Preliminary physics.' Forty of these are occupied by the development of the fundamental idea of the production of electricity by induction, which is accomplished in a manner not differing greatly from that of other similar treatises. The remainder contains the consideration of methods of electric measurements and measuring instruments. Including as it does dynamometric, photometric, and electric measurement proper, this comes near being the most unsatisfactory portion of the book. The great importance of thoroughly understanding this part of the subject is strongly emphasized; but the reader will seek in vain for its satisfactory elucidation. The study of dynamometers is by far the best of this part; and the translators have shown wisdom in inserting full descriptions of the Kent dynamometer prepared by Dr. Henry Morton, and of the Brackett dynamometer prepared by Professor Brackett, its inventor. Under electric measurement little is to be found, aside from the description of a few of the coarser devices for determining electromotive force and current strength, and there is really nothing concerning methods of measurement. Although the book is of very recent date, the units of measure are not defined in accordance with the agreement of the international electrical congress; and, in the discussion of photometric standards, no mention whatever is made of that adopted by that body. 'Intensity' for current, or current strength, and 'tension' for electromotive force, are found, unfortunately, throughout the work.

The bulk of the volume is devoted to descriptions of magneto and dynamo electric machines in great variety. These are generally given in considerable detail, accompanied by diagrams and plates. Many of the descriptions are very satisfactory, although most of them have appeared already in similar publications.

The concluding chapter contains a brief discussion of the theory of dynamo-electric machines, and a classification of dynamos. The discussion of the theory would be greatly improved by expansion, and the classification of dynamos would be more useful to the reader if introduced before the description of machines. An appendix contains a number of tables of considerable practical value, and an attempt to define the 'absolute, or C. G. S. system of units of measure.' In a previous chapter the necessity of being thoroughly fa-

Magneto and dynamo electric machines. By Dr. H. SCHELLEN. Vol. i. Translated from the third German edition by N. S. Keith and Percy Neymann. New York, *Van Nostrand*, 1884. 518 p. 8°.

miliar with these units is affirmed; but in these two pages a clear understanding of them is made well-nigh impossible. A single illustration will serve to show the character of many of these definitions.

"*The unit of tension* is that tension (potential difference) between two points which requires the expenditure of one unit of force (1 dyne) to move 1 coulomb from one point to the other by overcoming the electrical repulsion $\left(\text{Dim. } C^{\frac{1}{2}}G^{\frac{1}{2}}S^{-2}\right)$.

"*Technical unit*, 1 volt $= 10^8$ (C. G. S.) units."

BARNARD'S PYRAMID OF GIZEH.

Dr. Barnard tells us that Mr. Flinders Petrie, after having published a book in 1874 to give 'irrefragable proof' of the supernatural metrology of the Great pyramid, in 1880 printed another in which he recants all that doctrine. This surprising instance teaches us that it is possible for a man to hold the views of John Taylor and Piazzi Smyth, and yet be capable of using his mind sanely upon the subject. But Mr. Petrie had shown himself by his 'Inductive metrology' to be an adept in the logic of induction; and surely one would expect the study of logic, if it be of any use at all, to save a man from such follies as this metrological theory of the pyramid.

The main fallacy of the advocates of it is one which has been pointed out in C. S. Peirce's 'Theory of probable inference' as a violation of the inductive rule that the characters for which a lot is sampled ought to be predesignate; that is, settled upon before the examination of the sample. Given a collection of numerical data, it is always possible, by twisting them about, to find some recondite and curious relationship between them; for the possibilities of such relationships are endless. Mr. Pliny Earle Chase has convinced the world of that, if of nothing else.

Another thing which the pyramid-bitten seem to overlook, is that an hypothesis antecedently likely does not mean one which they are antecedently inclined to like, but one which belongs to a class of explanations among which the balance of positive evidence tends to show that the true theory is to be looked for.

Dr. Barnard treats the subject with a great deal of pertinent wit; he has drawn from the stores of his learning for interesting information on every page; and, what is best, he has estimated the strength of each argument with unerring good sense. Perhaps he is a little too indulgent to the idea that the vertical height of the pyramid was intended to bear the same ratio to the perimeter of the base that the radius of a circle bears to its diameter. Fourteen centuries after the building of the Great pyramid under King Apophis of the seventeenth dynasty (Joseph's Pharaoh, as it is said), was written the mathematical treatise of Ahmes, which has been preserved to us. This work virtually assumes

$$\pi = (\tfrac{4}{3})^4 = 3.16,$$

and there is no good reason for supposing that the pyramid-builder knew better. On the contrary, Sir Henry James's idea is probably correct, that the rule for the slope was, that at the corners the rise should be nine on a base of ten.

The supposition that the inclination of the entrance-passage was connected with a pole-star, derives, it would appear, its chief strength from its forming a part of Mr. Procter's ingenious theory of the orientation of the pyramid, which certainly has much to recommend it; yet the accuracy of orientation may be merely accidental, like that of the District of Columbia.

The imaginary metrological system of the Great pyramid of Gizeh. By F. A. P. Barnard. New York, *Wiley*, 1884. 5+106 p. 8°.

NOTES AND NEWS.

Mr. H. H. Warner of Rochester, N.Y., offers two prizes for the year 1885. First, two hundred dollars for each and every discovery of a new comet made from Feb. 1, 1885, to Feb. 1, 1886, subject to the following conditions: 1. It must be discovered in the United States, Canada, Mexico, West Indies, South America, Great Britain, or the Australian continent and islands, either by the naked eye or telescope, and it must be unexpected, except as to the comet of 1815, which is expected to re-appear this year or next; 2. The discoverer must send a prepaid telegram immediately to Dr. Lewis Swift, director, Warner observatory, Rochester, N.Y., giving the time of the discovery, the position and direction of motion, with sufficient exactness, if possible, to enable at least one other observer to find it; 3. This intelligence must *not be communicated to any other party or parties*, either by letter, telegraph, or otherwise, until such time as a telegraphic acknowledgment has been received by the discoverer from Dr. Swift (great care should be observed regarding this condition, as it is essential to the proper transmission of the discovery, with the name of the discoverer, to the various parts of the world, which will be immediately made by Dr. Swift). Discoverers in Great Britain, the Australian continent and islands, West Indies, and South America, are absolved from the restriction in conditions 2 and 3. Second, a prize of two hundred dollars in gold to

any person in the world who will write the best three-thousand-word paper on the cause of the atmospheric effects ('red light,' etc.) accompanying sunset and sunrise during the past sixteen months. It is desired that these papers be as original as possible in facts, observations, and treatment.

— Under the auspices of the Academy of natural sciences of Philadelphia, Prof. D. G. Brinton began on Jan. 26 to deliver a series of ten lectures on American ethnology and archeology. He will be followed by Professor Benjamin Sharp in a course of from twenty to twenty-five lectures on the principles of zoölogy; Professor Angelo Heilprin, a course of practical instruction in geology and paleontology, to be supplemented by field-excursions, and a final excursion to the region of the upper Delaware or the valley of Virginia, extending over a period of ten days or more; and Prof. H. Carvill Lewis, a course of twenty-five lectures on mineralogy and lithology, with practical demonstrations in the laboratory.

— The American philosophical society has just published an index to its Proceedings and Transactions down to 1883, prepared by Mr. Henry Phillips, jun., one of the secretaries. It will be found very useful, but would have been much more so had it been made in a single index, instead of in three, as at present. The simple prefix of P and T would have distinguished the Proceedings and the Transactions as readily as the present Roman numerals do the volumes; and a *T* could similarly have been made to indicate the old in distinction from the new series of the Transactions.

— The first number of the *Journal of mycology*, announced in a recent issue, has been received, and can hardly be said to promise much for the future of mycology in this country. It is almost wholly devoted to descriptions of new species; for the abstract of Wharton's paper on Fries's nomenclature of colors, taken from *Grevillea*, is of slight botanical value. If this number is an index of what is to come, it will be a matter of regret that the journal was ever started. The proper place for the description of species is in the proceedings of scientific societies, or in the reports issued by the different states or by the national government. In the case of a monthly journal, the necessity of filling the requisite number of pages must quickly result in the production of hastily or carelessly prepared descriptions, which will only be an encumbrance: the inevitable tendency will be to degenerate into a mere species-mill. Neither mycology nor any other natural-history science can hope for advancement through journals having no higher aim than this. And what shall we say to authors who describe one of their 'species,' and then add the following note: "It is quite probable that these are only the spores of some other fungus accidentally scattered on the leaves, and it is given here more especially to call attention to it, in order to ascertain its true character"?

— In the *Atlantic monthly* for February, Mr. Bradford Torrey has a pleasantly written paper on winter birds about Boston, in which he treats briefly the various species that enliven our fields and waysides at this inclement season. The writer shows himself to be a keen discriminating observer, as well as an affectionately appreciative one, and has also a happy way of telling what he has seen. His paper will prove of interest to the ornithologist as well as the general reader.

— Mr. W. W. Valentine of Richmond, Va., in the specimen pages of his 'Comparative study of the new high German language, theoretical and practical,' evidently gives a translation of the notes of some lectures on German grammar which he once heard in Germany. Like most lecture-notes, they contain some mistakes, and are, except for a reader already familiar with the subject, obscure through their conciseness. And if there has been in this book any winnowing, any selection at all of topics to be treated, the winnowing has certainly left much chaff among the wheat. It is difficult to conceive of any class of students in America who could, with advantage, study German in such a grammar. We subjoin a few characteristic extracts: "Consonants accumulate in simple words and compounds. It occurs often from the syncopation . . . In compounds they accumulate very often. — In English sex determines class-distinction for the most part. — The *es* of the neut. nom. acc. (also voc.) is often omitted in folk-speech, and also in poetry where it stands in connection with euphony and quantity. — Relics of gender are found with the demonstrative *das* that. — *Essen* (better *eszen*). [!!] — Reduplication occurred originally with the preterit stem of all stem verbs.—*falten* to fold (redupl.) Only the past participle is preserved in literary language." [!!]

— The fourth number of the *Anuario bibliográfico de la República argentina*, by A. N. Viola (Buenos Aires, 1883), contains a good account of the publications issued in that country for 1882. It comprises political and social subjects, as well as scientific and technical, and aims to include every thing bearing an Argentine imprint. Scientific subjects are allowed thirty pages, which are filled chiefly with mention of the work accomplished by several government institutions, such as the universities and the Cordoba observatory, and by the scientific societies of Buenos Aires and Cordoba. The entire list fills six hundred pages, small octavo. Another local list that deserves mention is Trautwein's *Bibliographie der alpinen literatur* for 1883, that has appeared for the last fourteen years in the *Zeitschrift des deutschen und oesterr. alpen-vereins*. It contains about four hundred titles; but journals are entered only by their name, not by their contents. There are no abstracts, and the arrangement is only by name of author; so that convenience of use would require more care expended in its preparation.

— Mr. A. M. Elliott, in the Johns Hopkins circular for December, writes of a philological expedition to Canada: —

"In point of language, the Canadian French is certainly one of the most interesting topics for a philologian. Here we find that time has stood still, especially for the more remote rural districts; and the scholar could easily imagine himself holding

intercourse with the subjects of Louis XIV. This means that we have the unique privilege, in this age of steam and travel, of studying in them a form of speech that has scarcely known change for the past two centuries. But this idiom is not a dialect of that remote period; and the greatest surprise to a student of language arriving in Canada is to find, that, contrary to the general impression of scholars, the vernacular does not bear any specific dialectic character, but is the middle (sixteenth century) French, with those natural changes which would be produced by the intimate fusion into a whole of all the different species of language that were originally brought from the mother-country. An influence upon the language must be noted in the original seigniorial tenure which prevailed throughout Lower Canada. The seigneurs were the second sons of noble families who chose the better class of peasants to accompany them to their homes in the new world; and here each ruler laid out on the river his little kingdom (generally $\frac{1}{4} \times 3$ leagues in dimensions), which he divided among his colonists in concessions of 3×30 arpents. This arrangement produced a series of centres of civilization in which the lord and his educated friends were brought into more or less intimate contact with the common people: in truth, we have abundant evidence to show that the relation of the seigneur to his people was much more intimate in these early settlements of Canada than in the mother-country. After the conquest (1760), nearly all the nobles fled the country, and the different classes of society were more thoroughly mixed than they had ever been before. The influence of long and constant contact with a Teutonic race has had the effect to temper the rash impulses of the Gaul; and this is in no respect more marked than in his speech, where a quiet monotony largely prevails, and strikes the stranger immediately as one of its leading characteristics. It has not the rhythm, the inexhaustible variety, and rich cadence of the Gallic tongue as it is spoken to-day in France."

Mr. Elliott also records the apparent vigor of the old French stock, and their wonderful absorbing-power, as shown by the curious phenomenon of a people in certain sections having the racial characteristics of the English or Scotch, and bearing the names of Warren, Frazer, and McDonald, and yet unable to speak a word of the mother-tongue. The English names of roads and villages show who the occupants of such places were a few years ago.

— A circular from the U. S. signal-office informs us, that, in accordance with the general assent of co-operating weather bureaus, the observations at our signal-service stations, as well as those of the widely extended international system, are now taken eight minutes and twelve seconds earlier than formerly, the change having been made on Jan. 1. The new time of the morning observation, which corresponds to the daily international observation, is therefore seven A.M. of our eastern standard, corresponding to Greenwich mean noon; and this has the great advantage of being recorded with the same name for the day of the week the world over.

— It was stated last spring that quantities of floating pumice, supposed to be derived from Krakatoa during the recent eruption, reached the island of Réunion, at the harbor of St. Paul, on the 22d of March, 1884, having thus made a voyage of some two hundred and six days at a rate of six-tenths of a mile an hour. It now appears that an immense quantity of pumice of similar appearance, and supposed to be from the same source, reached Tamatave, Madagascar, in the first week of September, 1884. Specimens have been sent to the Société de géographie, and will be reported upon by the director of the School of mines.

— Capt. Lundin of the bark Vega, at Philadelphia, reports that at three A.M., Dec. 22, in latitude 40° 31′ north, longitude 16° 10′ west, he felt several slight shocks of an earthquake. It was calm at the time.

— The distribution of time on a commercial basis is claiming the attention of inventors and capitalists. Besides the Standard time company of New Haven (which has been idle the past year, owing to an arrangement with the Time telegraph company of New York, which has now been terminated by the former company), there are the Standard time company of New York, now organizing, to distribute time on the Mayerhofer system of compressed-air impulses, synchronizing and winding secondary clocks; the National time-regulating company of Boston, which proposes to give audible signals over telephone-lines, which can be heard after the manner of repeating watches by placing the telephone to the ear; a company with headquarters at Pittsburg, which is to use the system devised by Mr. Gardner for long or short distance telegraph time-signalling and clock-synchronizing; the Time telegraph company of New York, which has shown its best development in the electric dial system in Providence; the Wenzel pneumatic system of clocks, actuated by compressed air acting through the medium of glass air-holders lifted out of a glycerine bath at each impulse; and we suppose that we shall soon have companies organized on the Popp-Resch-Mayerhofer system, now used in Paris, and the Mautner system of Vienna. Apropos of the subject, A. Merling has published an excellent little book on electrical clocks, entitled 'Die electrische uhren; Electrotechnische bibliothek, band ii. (Braunschweig, *Friedrich Vieweg und sohn*, 1884, 323 p., 12°); and M. A. Favarger continues his articles through the current year of the *Journal Suisse d'horlogerie* (Geneva), on 'L'électricité et ses applications à la chronométrie.'

— Dr. Hugo Gyldén, whose call to the professorship of astronomy in the university of Göttingen, made vacant by the death of Dr. Klinkerfues, we noted some time ago, has, in consequence of a liberal offer from the king of Sweden, decided to remain at his present post as astronomer royal, and director of the observatory at Stockholm. Dr. Gyldén is one of the editors of the new journal entitled *Act amathematica*.

— Dr. Th. Brédichin has resigned his position as director of the observatory at Moscow, Russia.

— The Roumanian government has voted the funds necessary for the establishment and maintenance of the Central meteorological observatory in Bucharest, and Mr. Hepites has been appointed the director.

— In November, 1884, Mr. Maxwell Hall, director of the Kempshot observatory, Jamaica, attacked again the question of the variability of the light of Neptune as bearing on the planet's rotation on its axis. He finds that fifteen rotation periods occupy 118.71 hours; so that each period is 7.914 hours, — a result which he considers identical with the period derived from his observations in 1883.

— The Lena polar expedition, commanded by Lieut. N. D. Jurgens, who arrived at St. Petersburg on Jan. 4, has proved a success. No one died or was seriously ill; scurvy, which appeared the first winter, being quickly suppressed. The second winter was somewhat milder than the first, although the spring and autumn were cooler. In western Siberia, in the *taiga* (forest) north of Jenisseisk, there was rain, and the rivers were open, as late as the 1st of December. The lowest temperature experienced by Lieut. Jurgens was — 50° C.; but the chief inconvenience was the frequent storms, although observations were not interfered with. Those of the first year have already been calculated by Mr. Eigner, who arrived in St. Petersburg in advance. The summer was almost without sun; and 12° C., the highest temperature recorded, was reached only once. This had a decided effect on the vegetation. Mosses were almost the only plant observed, and willows grow to a height of a few inches only, though inland, where the sea wind does not penetrate, they reach two feet. Magnetic disturbances were less frequent and important the second year than the first; thus proving the wisdom of the scientific men, who insisted that the observations should be made in 1882–83. The survey of the delta considerably changes our ideas about this region. Among other things, Sagastyr, where the observations were made, is not the most northern point of the delta; but this honor belongs to the Island Dunas, 74° north. The changes of water-level at Sagastyr are inconsiderable; the expanse of water being too large for high river-floods, and the tides small and irregular, largely influenced by the winds. Lieut. Jurgens left Sagastyr on July 8, passed several days at Yakootsk, whence he reached Kireusk by steamer in twenty-four days, and continued by boat on the Lena for two hundred versts; he was then obliged to travel by land, as ice was fast forming on the river. The journey to Irkutsk was made difficult by the lack of snow, which was also largely the case between Irkutsk and Neuberg, where he took the railroad. A telegram has just been received from Dr. Bunge, the naturalist of the expedition, who has not returned, stating that he is on the way to Irkutsk, where he will winter, and whence he will start early in the spring for the basin of the Jana, north-eastern Siberia, which he will explore in 1885, and in the spring of 1886 he will start for the New Siberia Islands.

— The publications of the second geological survey of Pennsylvania make steady progress. Reports on Cameron, Elk, Forest, Perry, Huntington, and Delaware counties, are in press. Reports on Lebanon, Dauphin, Cumberland, and Franklin counties, are partly prepared for the press, together with the remaining sheets of the South Mountain survey, one additional atlas and the second report of the progress of the anthracite survey, the second part of the report on the Monongahela collieries, and the second part of the report on Perry and Juniata counties. The state geologist has prepared a hand-atlas of the state, reducing the county maps in common use to a uniform scale of six miles to an inch, and coloring them geologically, according to the reports of progress in their respective districts, made to him by the assistant geologists of the survey. This atlas is just about to issue from the press. The board of commissioners has just recommended an appropriation of ninety thousand dollars for the next two years; twenty-five thousand dollars to be expended annually to continue the anthracite survey; ten thousand dollars annually to continue the topographical survey and commence the construction of a state map; and ten thousand dollars annually to extend the oil-region survey, to continue the chemical analyses of minerals, to provide for economic geological examinations in the bituminous and iron-ore regions, and to continue the work of the state geologist.

— At the annual meeting in February, according to *Nature*, the Royal astronomical society will award its gold medal to Dr. W. Huggins for his researches on the motions of stars in the line of sight, and on the photographic spectra of stars and comets. This is the second time that Dr. Huggins has received the medal, he, in conjunction with the late Professor Miller, having received it in 1867, for his researches in astronomical physics.

— At a meeting of the French academy of sciences on Jan. 5, Mr. Pasteur presented a paper, in the name of Mr. Duclaux, on the germination of plants in soil free from microbes. Mr. Duclaux had undertaken experiments in order to determine the effect of the presence of microbes upon germination. In his experiments he used pease and Holland beans, the cotyledons of which uniformly appear, one below the soil, the other above. The soil had been previously sterilized by processes of which the author gave no details, and, in addition, had been moistened with milk also sterilized. Under these conditions, germination did not take place, and at the end of two months the milk showed no indication of alteration. These two experiments tend to prove that the presence of microbes in the soil is necessary to the development and to the life of plants. Pasteur added some critical reflections. He mentioned that he had before this proposed to his pupils to examine what would happen to an animal subjected from birth to nourishment the elements of which had previously been freed of microbes, and consequently reduced to its nutritive principles, pure and simple. To this he had been led by the idea that in such conditions the maintenance of life and development would be impossible with animals. This conclusion leads to the

very important knowledge that the presence of microbes in foods is indispensable to digestion; that is to say, of actions necessary to the elaboration of matters destined to serve for the nutrition of the animal body. The total absence of microbes renders the accomplishment of these actions impossible. We can recognize the importance of an exact determination of the part played by microbes in digestion; for this knowledge would lead to interesting views, and perhaps to practical results, regarding the mechanism and treatment of different forms of dyspepsia.

— The enterprising scientific publisher, Doin, of Paris, sends out with the first number of *Revue scientifique* for this year the first number of a new journal, called *Journal des sociétés scientifiques*, which is to appear weekly, and to contain a brief report of the meetings of the principal scientific societies of the great cities of Europe. The plan of the journal is an excellent one, and one which should secure it an ample subscription list. It costs only fifteen francs, postage paid, to any part of the universal postal union. The first number contains reports of the French academy of sciences, the academy of medicine, and the geographical, anthropological, and biological societies of Paris, the societies of public medicine and of surgery, as well as of the academy of medicine of Belgium and Vienna, and the clinical society of London. It forms a quarto of ten pages.

— Among recent deaths we note the following: Benjamin Silliman, at New Haven, Jan. 14, at the age of sixty-nine; John Birmingham, astronomer, at Millbrook, Tuam (Ireland), Sept. 7, at the age of sixty-eight; Antoine Quet, physicist, at Paris, Nov. 29, at the age of seventy-four; Dr. E. V. Ekstrand, botanist, at Upsala, Nov. 10; A. Keferstein, lepidopterologist, at Erfurt, Nov. 28; Dr. Wilhelm Rüppell, the first scientific explorer of Nubia and Abyssinia, at Frankfort-on-Main, Dec. 11, at the age of ninety; Auguste Chevrolat, one of the founders of the French entomological society, at Paris, Dec. 16, at the age of eighty-five.

— With the completion of volume x. (for 1882), Dr. L. Just will resign the editorship of the *Botanisches jahresbericht*, which will then be privately conducted by Dr. E. Koehne of Berlin, and Dr. T. Geyler of Frankfort-on-Main.

— By the will of Mr. George Bentham, who died in September last, the Linnean society of London, and the Royal society scientific relief fund, will receive, *Nature* states, a thousand pounds each. The residue of his real and personal estate is to be held upon trust, to apply the same in preparing and publishing botanical works, or in the purchase of books or specimens for the botanical establishment at Kew, or in such other manner as his trustees, of whom Sir Joseph Hooker is one, may consider best for the promotion of botanical science.

— A "Report on the Egyptian provinces of the Sudan, Red Sea, and Equator, compiled in the intelligence branch quartermaster-general's department, horse-guards," has just been published by the war-office at London for three shillings and sixpence, and will be found of great service to those following the current events in upper Egypt, especially as it contains a capital map, and descriptions of all the routes of travel in the Egyptian Sudan known in July last.

— The capuchin, Father Massaga, who has spent thirty-five years as missionary in the African desert, has been commanded by the pope to write his memoirs, that they may be published by the curia. The memoirs will be in ten volumes, and will be illustrated by a Viennese artist.

— We learn from *Nature* that the German government has granted another sum of £7,500 for the scientific investigation of Central Africa, and £1,900 for the working-out of the materials collected by German polar expeditions.

— James Jackson, secretary of the French geographical society, has issued a new edition of his list of velocities. The first velocity given is that of the Mer de Glace, — according to Tyndall, .0000099 of a metre per second. The last, 463,500,000 metres per second, is that of the electricity in a wire connecting the inside and outside of a Leyden jar. What is meant by the latter velocity is not quite clear, when we consider that we can no more speak of the velocity of the conduction of electricity than we can of the velocity of the conduction of heat.

— Dr. Zulinski has published in a Warsaw medical journal the results of a long series of experiments made by him, both upon human beings and animals, with a view of verifying the physiological effects of tobacco-smoke. He found, in the first place, that it is a distinct poison, even in small doses. Upon men its action is very slight when not inhaled in large quantities; but it would soon become powerful if the smoker got into the habit of 'swallowing the smoke:' and Dr. Zulinski ascertained that this toxical property is not due exclusively to the nicotine, but that tobacco-smoke, even when disengaged of the nicotine, contains a second toxical principle called collidine, and also oxide of carbon and hydrocyanic acid. The effects produced by tobacco depend, he says, to a great extent upon the nature of the tobacco and the way in which it is smoked. The cigar-smoker absorbs more poison than the cigarette-smoker, and the latter, in turn, than those who smoke pipes; while the smoker who takes the precaution of using a nargile, or any other apparatus which conducts the smoke through water, reduces the deleterious effects of tobacco to a minimum. Dr. Zulinski considers the artificially lightened tobaccos to be more dangerous than the darker-colored ones.

— The article on economy of fuel, on p. 74 of this volume, contains an error to which a correspondent calls attention. It should have stated that the Oregon consumes 337 tons of coal per day, which gives combustion at the rate of over 1,500 pounds of coal for each mile traversed.